

Update on Global Cavity Database and Yield Evaluation

ILC Cavity Database Group:

S. Aderhold (DESY)
Z. Conway (Cornell)
R. Geng (JLab, SO Group Leader)
C.M. Ginsburg (FNAL)
Y. Yamamoto (KEK)

DESY Database Group:

D. Gall (DESY)
V. Gubarev (DESY)
S. Yasar (DESY)

Presented by Kirk Yamamoto

Global Cavity Database Motivation and Goals

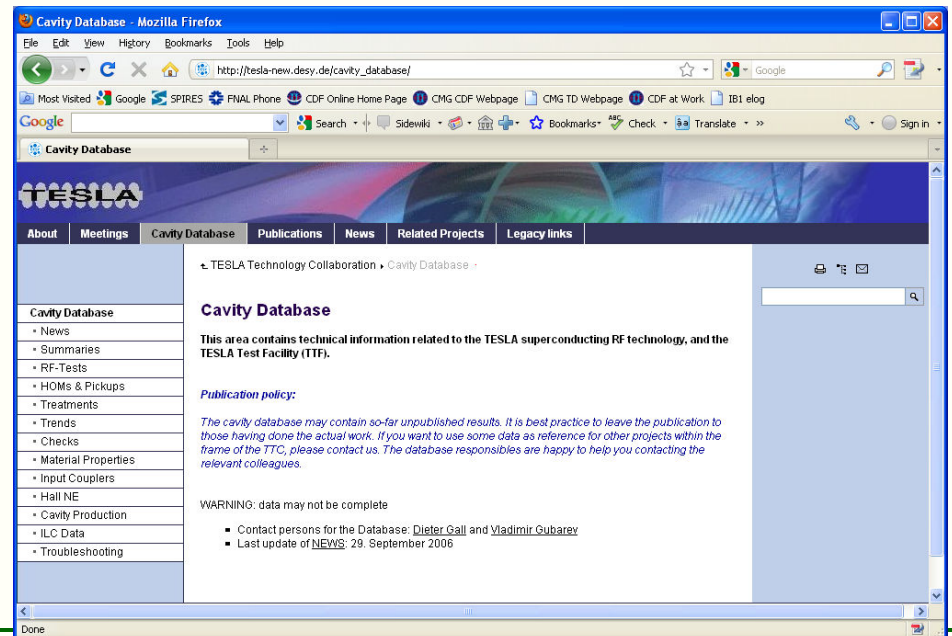
- Common data sample, well defined data cuts
 - Everyone uses the same data to make plots – a common denominator in yield calculations
 - Data cuts can be easily specified, and anyone could reproduce your results
- Data entry rules for reliable and reproducible results
 - All RF tests from the last couple of years are included; may be flagged for exclusion
 - Uniform criteria for data entry: only allowed values for as many as possible items
 - Define everything which might vary or have underlying subtleties, e.g., "LABX#1" might be a final surface treatment referenced as a well-defined recipe anyone can look up
 - No private/sensitive vendor data
 - Anything referred to in a comment field must be for information only, and not data selection purposes
 - Minimize effort required for compliance
 - Provide regular updates at predetermined times

ILC Database tool now fully functional

- ILC Database tool was created by the DESY database group
 - DESY kindly agreed to provide limited support for inclusion of global data into their database
- All the participating labs have put their data into the ILC Database
- ILC Database is now fully functional
 - http://tesla-new.desy.de/cavity_database/

Click on “ILC Data”

Two choices: read-only (public) & edit (requires login)



ILC Database Screenshot

ILC Cavity DB - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://tesla.desy.de/oracle/ilc/DataBase/view

Most Visited Google SPIRES FNAL Phone CDF Online Home Page CMG CDF Webpage CMG TD Webpage CDF at Work IB1 elog

Google Search Sidewiki Bookmarks Check Translate AutoLink AutoFill Sign in

Window

ORACLE

CW-Test Results

Marked: 5

Default Statistics (31) User-defined Statistics (3) Print

Cavities

- Z139
- Z140
- Z141
- Z143
- Z144
- Z145
- Fermilab
 - ACCEL/RI
 - 9.cell
 - A8
 - A9
 - ACCEL6
 - ACCEL7
 - TB9ACCD11
 - TB9ACCD12
 - TB9ACCD13
 - TB9ACCD14
 - TB9ACCD15
 - AES
 - JLAB
 - KEK
 - MHI
 - 9.cell
 - MHI005
 - MHI006
 - MHI007

Accept

Cavity Information

Cavity	Owner	Vendor	Arrival Date	Test No.	Last Surface Treatment	Removed Mater. [mu-m]	Last HT before Test	Test Date	Test Location	Max. Eacc [MV/m]	Qo @ Max. Eacc	Limitation	Eacc @ (100W/9) cell#	Included
AC115	DESY	ACCEL/RI	24.Apr.08	1	DESY#2	204	DESY-800C	11.Dec.07	DESY	38.6	1.1E+10	FE/quench		Yes
				2	DESY#2	253		01.Oct.08	DESY	36.9	1.3E+10	FE/quench		Yes
Z143	DESY	ZANON	03.Jan.08	1	DESY#2	163	DESY-800C	09.Oct.08	DESY	32.6	8.1E+09	FE/quench		Yes
				2	HPR only	263		12.Nov.08	DESY	41.0	1.1E+10	FE/quench		Yes
A9	Fermilab	ACCEL/RI	29.Jan.07	1	Cornell#1	220	JLab-600C	15.Aug.07	Cornell	26.0	7.0E+09	FE/quench		Yes
				2	Cornell#1	20		14.Sep.07	Cornell	26.0	2.0E+10	Quench		Yes
				3	Cornell#1	30		24.Dec.08	Cornell			other (please)		No
				4	none	0		03.Feb.09	Cornell			other (please)		No
				5	none	0		12.Mar.09	Cornell	26.0	6.0E+09	FE/quench		Yes
TB9ACCD13	Fermilab	ACCEL/RI	28.Nov.07	1	JLab#1		JLab-600C	01.Dec.08	JLab	41.8				Yes
				2	JLab#1			27.Mar.09	Fermilab	38.0		FE/quench		Yes
MHI005	KEK	MHI	29.Feb.08	1	KEK#1	175		05.Dec.08	KEK	27.3	3.7E+09	FE/quench		Yes
				2	KEK#1	225		26.Feb.09	KEK	19.7	1.2E+10	FE/quench		Yes
				3	KEK#1	245		17.Apr.09	KEK	27.1	7.5E+09	FE/quench		Yes

Cavity remark: more improved in EBW procedure than MHI#1 - #4 cavities

Test result: Mode measurement: Max Eacc = 36MV/m at cell 1 and 9, 32MV/m at cell 2 and 8, 34MV/m at cell 3, 4, 6 and 7, 31MV/m at cell 5. T-mapping: cell 5 at pi and 3pi/9, cell 1 and 9 at 4pi/9.

Remark: Optical inspection: No correlation between heating location and several pits. EBW seam around heating location was not good.

Accept remark:

Appllet oracle.forms.engine.Main started

For those who have used the DESY database, this will look and feel very familiar

ILC Database: Selected Features (1)

Order and select cavities by features

Results for ILC Cavities

Marked: 119

Standard Yield Plot (26) User Yield Plot (26) Print Quit

✓ Show Details

Cavity Information						RF Test Information										
Cavity	Owner	Vendor	Arrival Date	Bulk Surface removal technique	Test No.	Last Surface Treatment	Removed Mater. [mu-m]	Last HT before Test	Test Date	Test Location	Max. Eacc [MV/m]	Qo @ Max. Eacc	Limitation	Eacc @ (100W/9) cell#	Included	Statistics
					7	none	327		17.Mar.08	DESY	17.5	1.5E+09	Field emission		Yes	
					10	HPR only	375		14.Jan.09	DESY	42.4	6.8E+09	FE/quench		Yes	
					11	HPR only	375		18.Jun.09	DESY	41.0	1.0E+10	FE/quench		Yes	
AC113	DESY	ACCEL/RI	28.Jul.06	DESY bulk BCP	3	DESY#1	140		21.Mar.07	DESY	27.3	1.7E+10	Quench		Yes	
AC114	DESY	ACCEL/RI	10.May.06	DESY bulk BCP	2	DESY#1	140		08.Mar.07	DESY	26.8	1.6E+10	Quench		Yes	
					3	DESY#4	236		03.Dec.07	DESY	14.1	1.6E+10	Quench		Yes	
					4	none	236		06.Dec.07	DESY	13.7	1.6E+10	Quench		Yes	
					5	HPR only	236		23.Jan.09	DESY	14.1	1.5E+10	Quench		Yes	
AC115	DESY	ACCEL/RI	24.Apr.08	DESY bulk EP	1	DESY#2	204	DESY-800C	11.Dec.07	DESY	38.6	1.1E+10	FE/quench		Yes	
					2	DESY#2	253		01.Oct.08	DESY	39.9	1.3E+10	FE/quench		Yes	
AC116	DESY	ACCEL/RI	25.May.07	ACCEL bulk EP	1	DESY#5	150	DESY-800C	22.Feb.08	DESY	26.7	6.4E+09	FE/quench		Yes	
AC117	DESY	ACCEL/RI	28.Feb.07	DESY bulk EP	1	DESY#5	163	DESY-800C	19.Jul.07	DESY	21.6	6.1E+09	Field emission		Yes	
					2	none	163		26.Jul.07	DESY	23.3	1.2E+10	Field emission		Yes	
					3	HPR only	163		27.Aug.07	DESY	31.5	1.1E+10	Field emission		Yes	

Cavity remark:

Test result: additional 6xHPR after leak detected

Remark:

Accept remark:

Accept

Extract data in ASCII format and use your private spreadsheet

Make the standard first-pass yield plot defined by ILC DB group,
or make a plot using your own selection



ILC Database: Selected Features (2)

The screenshot displays the 'CW-Test Results for ILC Cavities' application. It features a tree view on the left with a list of cavities (A8, A9, AC112, AC113, AC114, AC120, AC121, AC128, AC148, AES001, MHI006, Z82, Z83) and a main table with columns for Cavity, Owner, Vendor, Arrival Date, Bulk Surface Removal Technique, Test No., Last Surface Treatment, Removed Mater. [mu-m], Last HT before Test, Test Date, Test Location, Max. Eacc [MV/m], Qo @ Max. Eacc, Limitation, Eacc @ (100W/95) cell#, and Statistics. Two dialog boxes are open: 'DESY#2' and 'FE/quench'. Red circles highlight 'DESY#2' in the table and 'FE/quench' in the 'Limitation' column, with red arrows pointing to their respective dialog boxes.

Cavity	Owner	Vendor	Arrival Date	Bulk Surface Removal Technique	Test No.	Last Surface Treatment	Removed Mater. [mu-m]	Last HT before Test	Test Date	Test Location	Max. Eacc [MV/m]	Qo @ Max. Eacc	Limitation	Eacc @ (100W/95) cell#	Included	Statistics
					7	none	327		17.Mar.08	DESY	17.5	1.5E+09	Field emission		Yes	<input type="checkbox"/>
					10	HPR only	375		14.Jan.09	DESY	42.4	6.8E+09	FE/quench		Yes	<input type="checkbox"/>
					11	HPR only	375		18.Jun.09	DESY	41.0	1.0E+10	FE/quench		Yes	<input type="checkbox"/>
AC113	DESY	ACCEL/RI	28.Jul.06	DESY bulk BCP	3	DESYS#1	140		21.Mar.07	DESY	27.3	1.7E+10	Quench		Yes	<input type="checkbox"/>
					4	DESYS#4	188		07.Feb.08	DESY	36.8	6.5E+09	Field emiss		Yes	<input type="checkbox"/>
AC114	DESY	ACCEL/RI	10.May.06	DESY bulk BCP	2	DESYS#1	140		08.Mar.07	DESY	26.8	1.6E+10	Quench		Yes	<input type="checkbox"/>
					3	DESYS#4	236		03.Dec.07	DESY	14.1	1.6E+10	Quench		Yes	<input type="checkbox"/>
					4	none	236		06.Dec.07	DESY	13.7	1.6E+10	Quench		Yes	<input type="checkbox"/>
					5	HPR only	236		23.Jan.09	DESY	14.1	1.5E+10	Quench		Yes	<input type="checkbox"/>
AC115	DESY	ACCEL/RI	24.Apr.08	DESY bulk EP	1	DESYS#2	104	DESY-800C	11.Dec.07	DESY	36.6	1.1E+10	FE/quench		Yes	<input checked="" type="checkbox"/>
					2	DESYS#2	253		01.Oct.08	DESY	36.9	1.3E+10	FE/quench		Yes	<input type="checkbox"/>
25.May.07		ACCEL bulk EP			1	DESYS#5	150	DESY-800C	22.Feb.08	DESY	36.7	6.4E+09	FE/quench		Yes	<input type="checkbox"/>
28.Feb.07		DESY bulk EP			1	DESYS#5	163	DESY-800C	19.Jul.07	DESY	21.6	6.1E+09	Field emission		Yes	<input type="checkbox"/>
					2	none	163		26.Jul.07	DESY	23.3	1.2E+10	Field emission		Yes	<input type="checkbox"/>
					3	HPR only	163		27.Aug.07	DESY	31.5	1.1E+10	Field emission		Yes	<input type="checkbox"/>

DESYS#2

- cleaning
- electropolishing (48 um)
- HPR
- ethanol rinse
- clean room assembly
- tank welding
- clean room assembly
- 6 x HPR
- 120C baking for 48h

FE/quench

Test ends in quench, accompanied by significant field emission. You may or may not think that field emission caused the quench.

Click on an item to bring up a dialog box explaining definition

ILC Database Status/Plans

- All baseline requirements have been implemented by the DESY DB group
- A few fine-tuning items are still under discussion, to be implemented as time is available, e.g.,
 - How best to incorporate inevitable changes to the logic for standard plots
 - Implement more standard plots, etc.
- All cavity yield plots in the rest of this talk use data extracted from the ILC Database



LCWS2010 Cavity Yield Dataset

- ILC Database currently contains data from all three regions, from the last few years [92 cavities]
 - KEK [5 cavities]: [MHI005:MHI009]
 - JLab, Cornell, Fermilab [22 cavities]: [A5: A9], [TB9ACC010:TB9ACC017], [AES001:AES004], [TB9AES005:TB9AES010], JLAB-2
 - DESY [65 cavities]: [Z82:Z110], [AC112:AC129], [Z130:Z135,Z137:Z145], [AC147,AC149,AC150] (Production 4,5,6,7)

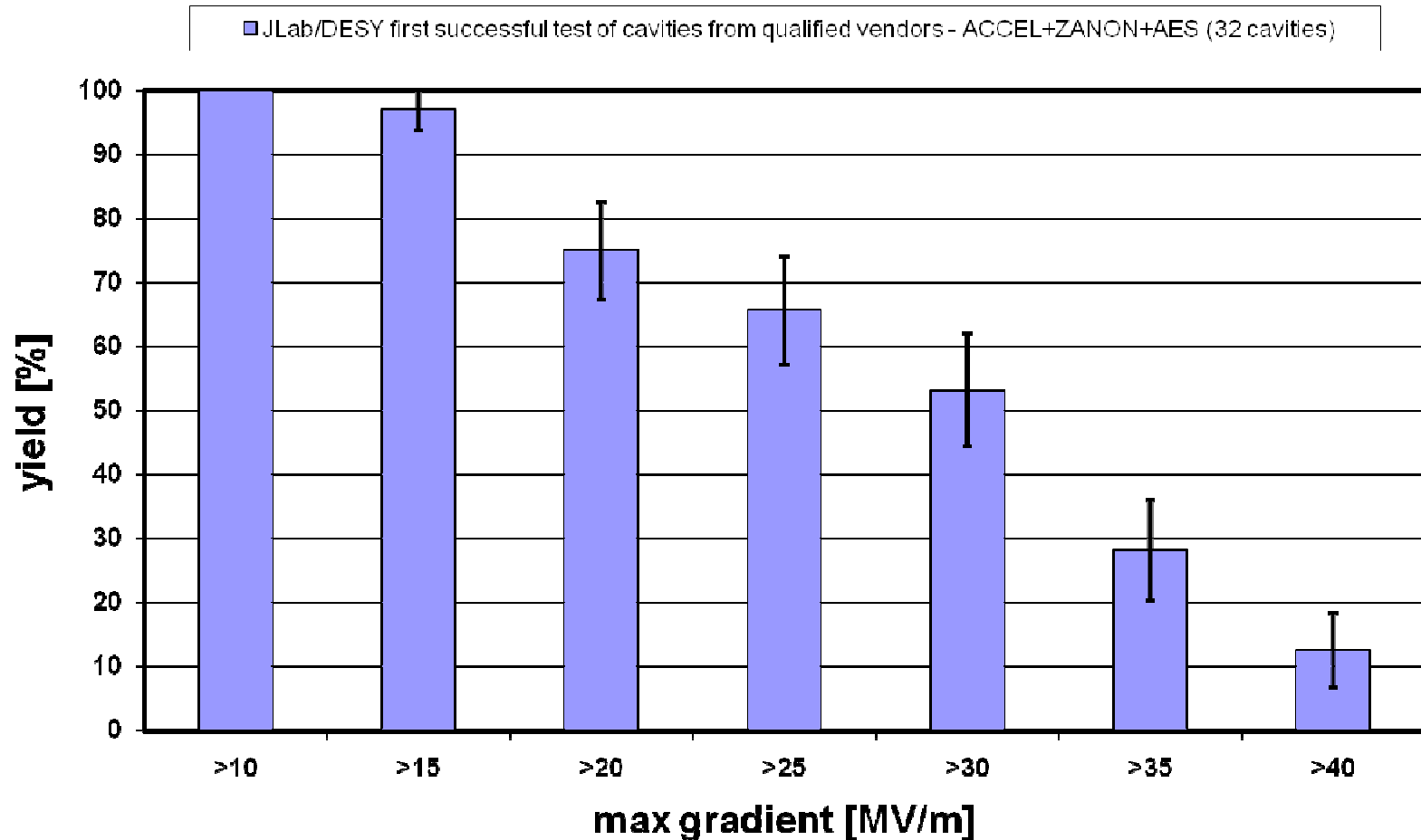
“Qualified-Vendor” Production Yield Plot (First Pass) - Definition

- **ILC Database 26.Mar.2010**
- **Cuts**
 - **Cavity from qualified vendor= ACCEL or ZANON or (AES SN \geq 5)**
 - **Fine-grain cavity**
 - **Use the first successful (= no system problem/limitation) test**
 - **Standard EP processing: no BCP, no experimental processes**
 - **Defined as JLab#1, DESY#2 (weld tank before test), DESY #4 (weld tank after test)**
 - **Ethanol rinse and 120C bake required for DESY cavities**
 - **(Ignore test limitation)**
- **Also known as “first-pass”**
- **Include binomial errors**



“Qualified-Vendor” Production Yield Plot (First Pass)

Electropolished 9-cell cavities



First-pass cavity yield at >25 MV/m is (66 ± 8) %

>35 MV/m is (28 ± 8) %

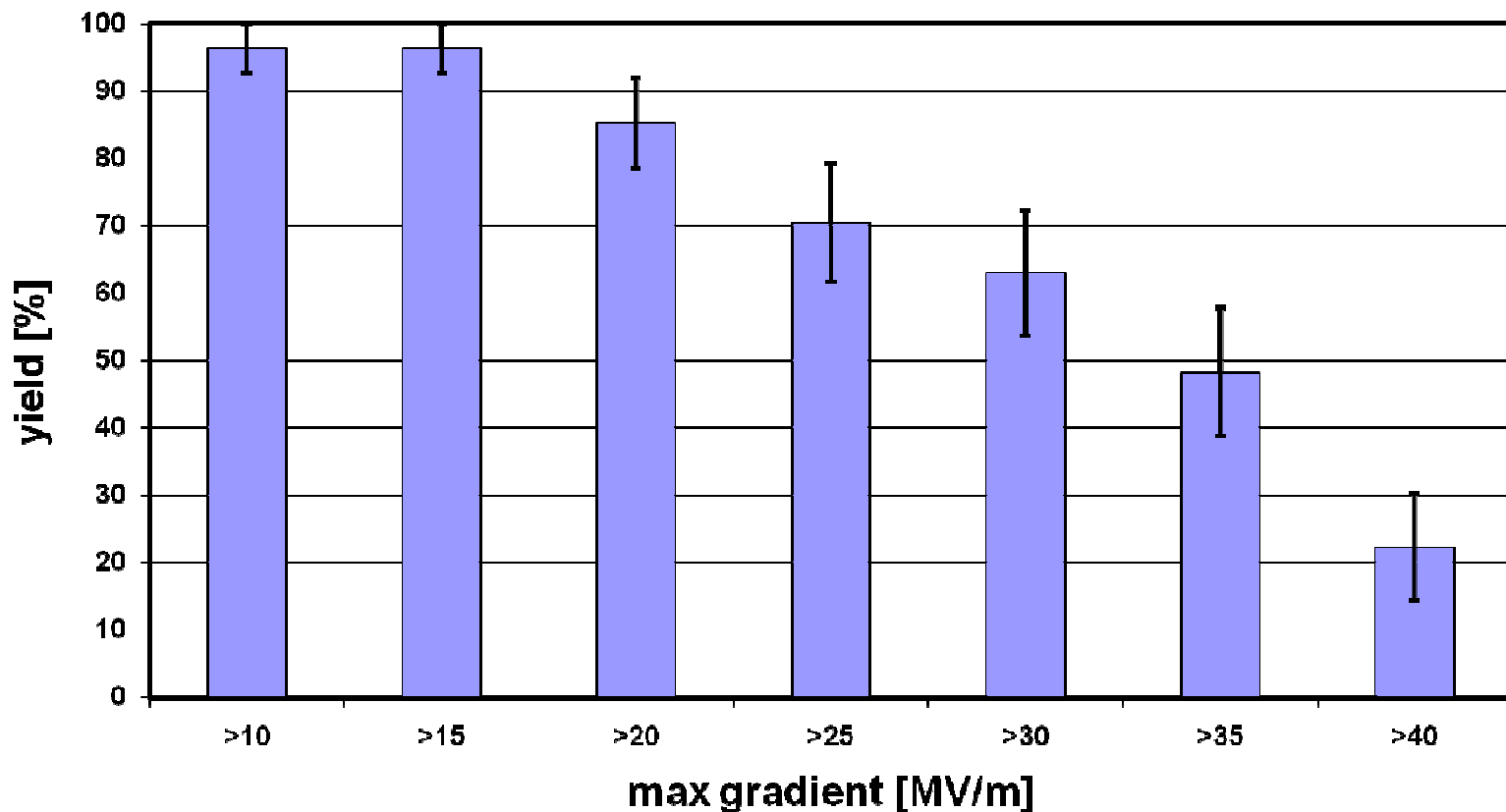
ILC Up-to-second-pass" Production Yield Plot (qual. vendor) - Definition

- ILC Database 26.Mar.2010
- Cuts
 - Cavity from qualified vendor: ACCEL or ZANON or (AES SN \geq 5)
 - Fine-grain cavity
 - Use the first successful (= no system problem) test
 - Standard EP processing: no BCP, no experimental processes
 - Defined as JLab#1, DESY#2 (weld tank before test), DESY #4 (weld tank after test)
 - (Ignore test limitation)
 - Second pass
 - if (Eacc(1st successful test) $<$ 35 MV/m) then
 - if (2nd successful test exists) then
 - » plot 2nd test gradient
 - else
 - » plot nothing [assume 2nd test didn't happen yet]
 - endif
 - else
 - plot 1st successful test gradient
 - endif
- Include binomial errors

“Qualified vendor” Up-to-Second Pass Yield

Electropolished 9-cell cavities

■ JLab/DESY (combined) up-to-second successful test of cavities from qualified vendors - ACCEL+ZANON+AES (27 cavities)

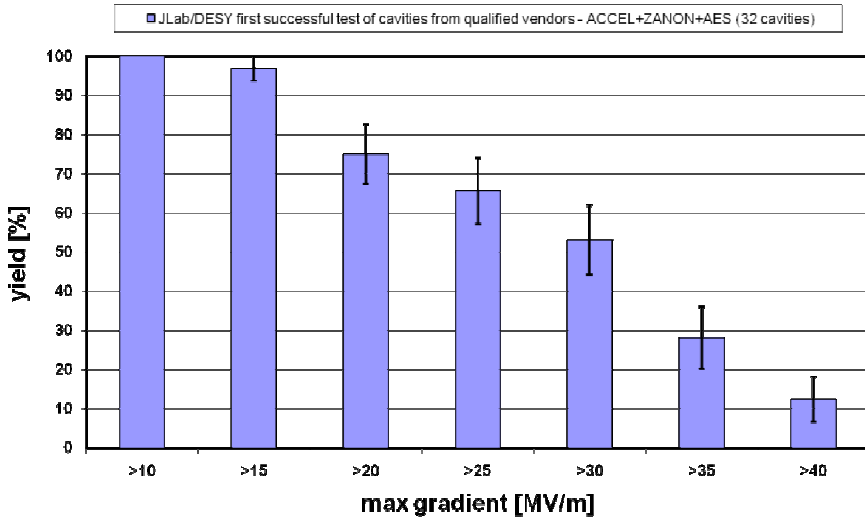


Up-to-second-pass cavity yield at >25 MV/m is (70 ± 9) %

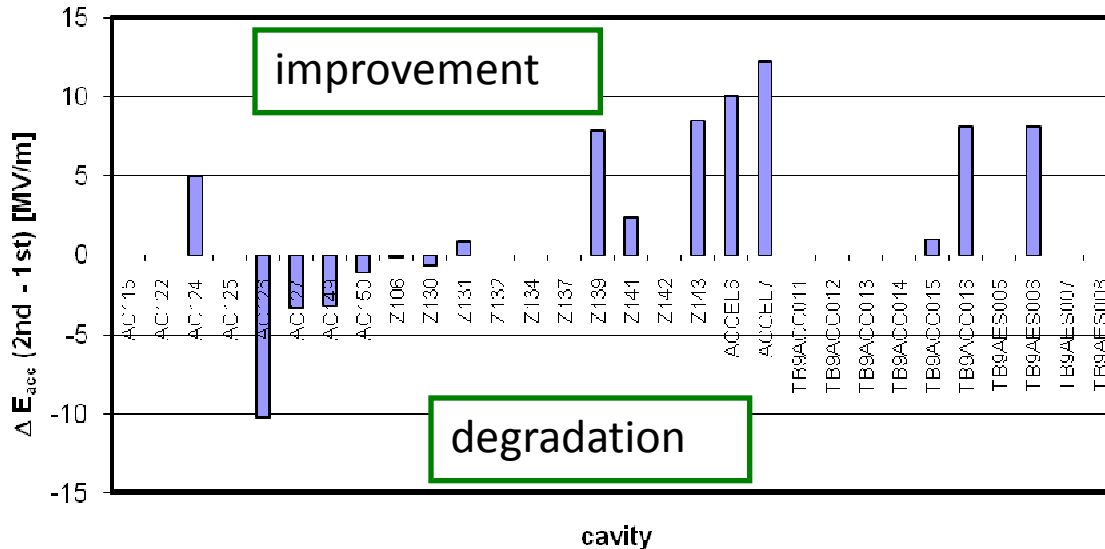
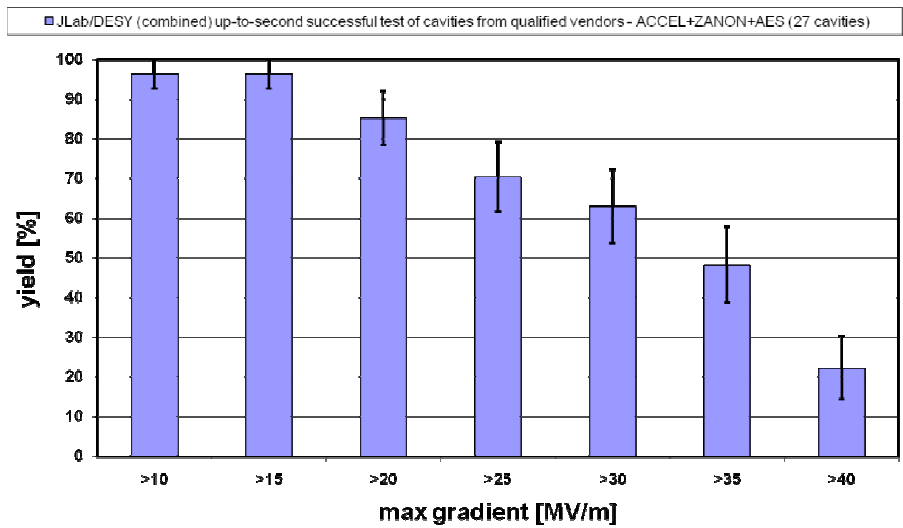
>35 MV/m is (48 ± 10) %

Compare 1st and 2nd pass yields

Electropolished 9-cell cavities



Electropolished 9-cell cavities



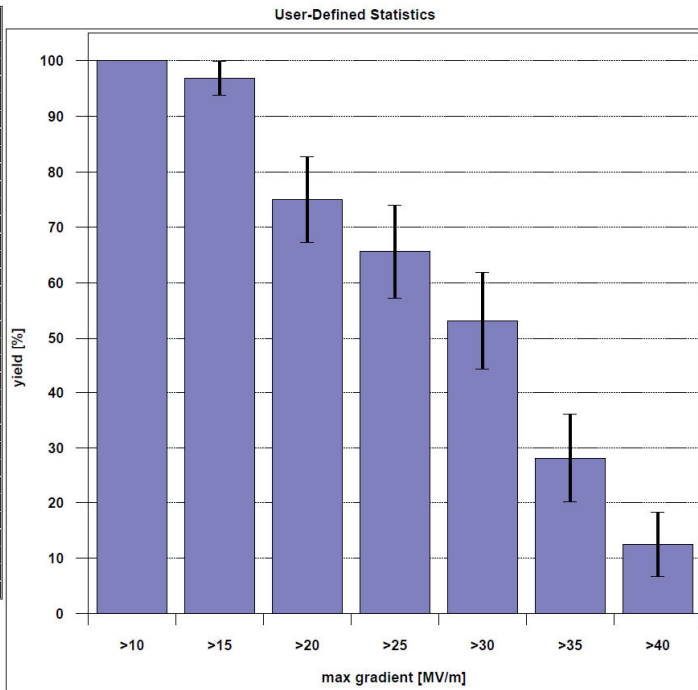


Compare 1st and 2nd pass yields (updated!)

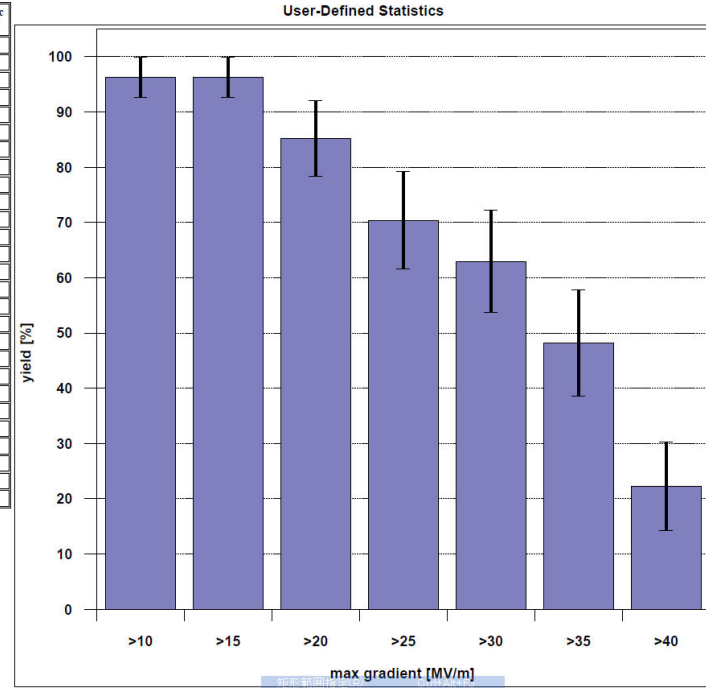
1st pass

2nd pass

No.	Cavity	Test Date	Max. Eacc [MV/m]
1	TB9ACC013	01.Dec.08	41.80
2	TB9ACC014	09.Feb.09	41.50
3	TB9AES008	26.Aug.09	41.10
4	TB9AES007	16.Mar.10	41.00
5	AC122	26.Aug.08	38.88
6	AC115	11.Dec.07	38.60
7	TB9AES010	06.Nov.09	37.70
8	TB9ACC011	21.Aug.08	37.00
9	TB9ACC012	07.Jul.08	35.10
10	Z134	13.Nov.09	34.94
11	AC125	15.Jun.08	34.59
12	AC150	30.Jan.09	34.33
13	TB9AES009	18.Aug.09	33.40
14	Z143	09.Oct.08	32.57
15	Z106	21.Feb.07	31.70
16	AC127	13.Feb.09	31.25
17	TB9ACC016	14.Dec.09	31.20
18	ACCEL7	05.Sep.06	29.00
19	AC149	28.Jan.09	26.51
20	AC124	05.Feb.09	26.01
21	Z137	24.Feb.09	25.23
22	Z139	12.Sep.08	24.93
23	Z142	01.Jul.09	20.58
24	TB9AES005	27.Mar.09	20.50
25	ACCEL6	12.Dec.06	19.00
26	Z141	16.Apr.08	18.29
27	TB9ACC015	02.Jul.08	18.00
28	Z130	01.Sep.08	17.30
29	Z131	20.Aug.08	17.17
30	Z132	19.Aug.08	16.83
31	AC126	05.Sep.08	16.37
32	TB9AES006	09.Apr.09	14.10



No.	Cavity	Test Date	Max. Eacc [MV/m]
0	TB9ACC013	01.Dec.08	41.80
1	TB9ACC014	09.Feb.09	41.50
2	ACCEL7	18.Jan.07	41.20
3	TB9AES008	26.Aug.09	41.10
4	Z143	12.Nov.08	41.00
5	TB9AES007	16.Mar.10	41.00
6	TB9ACC016	11.Feb.10	39.30
7	AC122	26.Aug.08	38.88
8	AC115	11.Dec.07	38.60
9	TB9AES010	06.Nov.09	37.70
10	TB9ACC011	21.Aug.08	37.00
11	TB9AES009	07.Oct.09	36.00
12	TB9ACC012	07.Jul.08	35.10
13	AC150	08.May.09	33.23
14	Z139	20.Oct.08	32.75
15	Z106	27.Feb.07	31.50
16	AC124	19.May.09	30.93
17	ACCEL6	23.Jan.07	29.00
18	AC127	11.Jun.09	27.85
19	AC149	05.May.09	23.27
20	TB9AES006	11.Sep.09	22.20
21	Z141	14.May.08	20.70
22	TB9AES005	09.Apr.09	20.50
23	TB9ACC015	14.Jul.08	19.00
24	Z131	25.Nov.08	17.96
25	Z130	15.Oct.08	16.60
26	AC126	21.Oct.08	6.14



Yield as a Function of Time (one way of looking at it...)

	yield for [%]			
	>25 MV/m		>35 MV/m	
	1st pass	2nd pass	1st pass	2nd pass
ALCPG-Albuquerque 1.Oct.2009	63+-10	67+-10	23+-9	33+-10
AAP-Oxford 6.Jan.2010	63+-9	64+-10	27+-8	44+-10
LCWS-Beijing 28.Mar.2010	66+-8	70+-9	28+-8	48+-10

NB: errors are very strongly correlated

Within the very limited additional statistics accumulated over the last six months there appears to be improvement in the yield

Summary

- ILC Database now fully functional and available for use
- Updated yield plots were shown
 - First-pass cavity yield at >25 MV/m is (66 ± 8) %
 - >35 MV/m is (28 ± 8) %
 - Up-to-second-pass cavity yield at >25 MV/m is (70 ± 9) %
 - >35 MV/m is (48 ± 10) %
- We will continue to update the ILC database as we have more cavity tests, and systematically update the cavity yield data